

BeppoSAX ToO Observations on BLAZARS

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ABSTRACT. We summarize the results of *BeppoSAX* ToO observation of blazars that were known to be in a high state from observations carried out in the optical or X-ray or TeV bands. In some of the sources observed, two spectral components were detected, which are interpreted as synchrotron and inverse Compton emission, respectively. Fast variability was detected in three sources (ON 231, BL Lac and S5 0716+714), but always only for the synchrotron component. Most of the triggers are from optical observations, consequently most of the sources observed are LBL or intermediate objects. They were in a high state in the X-ray band, but not in an exceptionally high state. No strong shift in the synchrotron peak frequency are reported. This is in line with the findings that the synchrotron peak frequency is more variable for HBL objects, i.e. sources that have this peak at higher energies.

1. Introduction

Determining the continuum production mechanism is critical for understanding the central engine in AGN, a fundamental goal in extragalactic astrophysics. The continuum emission of the Blazar class of Active Galactic Nuclei (AGN) is dominated by non-thermal radiation from the radio to the X ray, up to the MeV, GeV and in some cases TeV energy bands. This emission is often rapidly variable at all frequencies and, in general, it has been observed that the amplitude of flux density variations increases and the time scales decrease as a function of frequency from the radio to the X-ray. A natural explanation is that Blazars are dominated by relativistic jets at small angles to the line of sight (Blandford & Rees 1978; Urry & Padovani 1995).

The variability behaviour of a blazar in a given band depends also from its Spectral Energy Distribution (SED). It is well known that the Blazar SED is double-peaked (in a ν vs νf_ν representation). This is interpreted as due to non thermal synchrotron self-compton (SSC) emission, with the first component due to synchrotron radiation and peaking at IR to X-ray frequencies and the second one due to inverse Compton scattering and peaking in the GeV to TeV band (e.g. Fossati et al. 1998). The location of the synchrotron peak is used to define different classes of Blazars: HBL (High frequency peak Blazars) and LBL (Low frequency peak Blazars) (Giommi & Padovani 1994). In the most studied bands, i.e. radio, optical and X-ray, one expects that different sources have different variability behaviour, depending from where the synchrotron peak is located. Normally one expect that the variability is more enhanced after the synchrotron peak, towards the end part of the synchrotron emission, where the cooling time of the electron is shorter. Longer time scale are expected, and observed, in the radio and far-IR bands. Correspondingly, in the X-ray band we expect fast variability for sources that hare dominated by the synchrotron emission (HBL), while for the sources whose X-ray emission is due to the inverse Compton mechanism we do not expect frequent and rapid variability. Actually, the same source can have the synchrotron peak located at different frequencies, e.g. in the presence of flare like events, as the one seen in Mkn 501. This can be explained as due to the injection of fresh electron in the jet (Pian et al. 1998).

Since Blazars emit over the entire electromagnetic spectrum, a key for understanding blazar variability is the acquisition of several wide band spectra in different luminosity states during major flaring episodes. Coupling spectral and temporal information greatly constrains the jet physics, since different models predict different variability as a function of wavelength. Before the *BeppoSAX* advent, important progress in this respect has been

achieved for some of the brightest and most studied blazars, as PKS2155-304 (Urry et al. 1997), BL Lac (Bloom et al. 1997), 3C 279 (Wehrle et al. 1998). However, thanks to its good energy resolution and sensitivity over an unprecedented large X-ray energy band, from 0.01 up to 200 keV, *BeppoSAX* immediately provided unique results in the multiwavelength study of Blazar (e.g. PKS 2155-304 Giommi et al. 1998, Chiappetti et al. 1999; Mkn 501 Pian et al. 1998). Having in mind all these results we successfully used the *BeppoSAX* satellite to perform Target of Opportunity (ToO) observations of blazars, that were known to be in a high state from observations carried out either in the optical or X-ray or TeV bands.

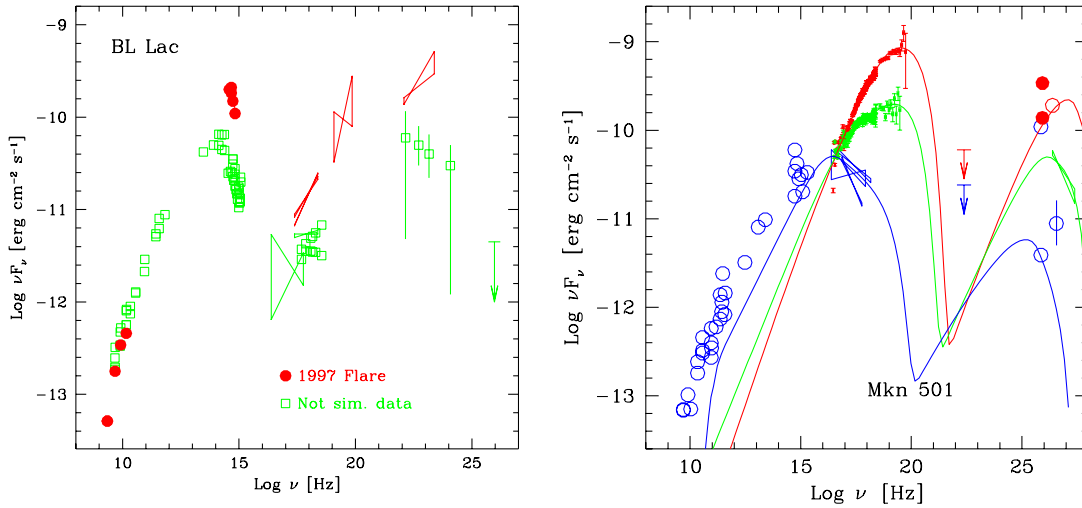


Fig. 1. **Left:** The SED of BL Lac during the flare in the summer 1997 (filled symbols, see Bloom et al. 1997) compared to its ‘quiescent’ level, constructed collecting non-simultaneous data found in literature.

Right: Two *BeppoSAX* observations of Mkn 501 while it was in a high state of activity, compared to previous observations. Note the extremely large shift of the synchrotron peak toward higher energies.

This ToO program was motivated in particular by two spectacular cases. The first is the 1997 multiwavelength flare of BL Lac, that we used as the paradigmatic case for the optical triggering. During this flare a number of ground based telescope as well as satellites (ISO, XTE, ASCA and EGRET) were promptly pointed to BL Lac, triggered by the optical observations (IUAC 6693, 6700) of a brightening of over 1 mag. Data taken within the flaring period are reported in Fig. 1 (left panel, filled symbols), where they are compared to previous data. It is evident the increase of the flux at all wavelengths, especially in the X-ray band and in the γ -ray EGRET band, testifying the large increase of the bolometric luminosity. Particularly interesting is the behaviour in the X and γ -ray range, where also large spectral variations are evident. This challenges any model: for instance, in the synchrotron self-Compton scenario, an increasing number of emitting electrons leads to a linear increase of the optical (synchrotron) flux and to a quadratic increase of the X and γ -ray (Compton) flux, as observed, but this model does not simply account for the flattening of the γ -ray spectrum and the corresponding shift of the peak of the Compton component. The second case was provided by the

BeppoSAX observations of Mkn 501. Quiescent for all 1996, as witnessed by the All Sky Monitor onboard RossiXTE, at the beginning of 1997 Mkn 501 entered in an extremely high activity phase. Continuous flaring activity was detected in the TeV band, with flux levels reaching 4–8 times the level of the Crab. *BeppoSAX* observations were scheduled during one of these flares, leading to the discovery of an unprecedented X-ray emission for this object (Pian et al. 1998), with a synchrotron spectrum peaking at or above 100 keV. Compared to previous observations, the peak shifted by more than two decades in frequency (see Fig. 1). This was used as the best case for a X-ray or TeV trigger.

As part of our ToO program we observed 7 different blazars, some of them more than one time, over a period of 3.5 years. The journal of these observations are given in Table 1, where we report the source name, the observation date, the exposure time and the trigger criteria that started the observation (optical or X-ray, unfortunately we did not have a TeV trigger). We also report other two ToO observation of Blazars that were carried out by *BeppoSAX*, but that were not part of our program. They are Mkn 421 (Malizia et al. 2000) and OJ 287 (Massaro et al. 2002). We will now give the results of some of these observations in more details.

TABLE I
Journal of the *BeppoSAX* Blazars ToO observations

Source Name	Observ. Date	Exposure	Trigger
ON 231	11 May 1998	25 ks	optical
	11 Jun 1998	32 ks	
PKS 2005-489	01 Nov 1998	52 ks	X-ray
BL Lac	05 Jun 1999	54 ks	optical+X-ray
	05 Dec 1999	54 ks	
OQ 530	03 Mar 2000	26 ks	optical
	26 Mar 2000	23 ks	
S5 0716+714	30 Oct 2000	43 ks	optical
MS 14588+2249	19 Feb 2001	48 ks	optical
1ES 1959+65	23 Sep 2001	7 ks	optical
	28 Sep 2001	48 ks	
Mkn 421	22 Jun 1998	32 ks	X-ray
OJ 287	20 Nov 2001	40 ks	Optical

2. The Observations

ON 231: this BL Lac object ($z = 0.102$), which had been observed in the X-ray band by *Einstein* IPC in June 1980 with a 1 keV flux of $1\mu\text{Jy}$ (Worrall & Wilkes 1990) and by ROSAT PSPC in June 1991 with a 1 keV flux of $0.4\mu\text{Jy}$ and energy spectral index $\alpha = 1.2$ (Lamer et al. 1996, Comastri et al. 1997), had an exceptional optical outburst in April–May 1998, reaching the most luminous state ever recorded, about 40 mJy in the R band. The optical broad band spectrum was strongly variable. In particular, it was very flat at the maximum with a broad band energy spectral index of 0.52, while before the flare it was found to be 1.4; the peak frequency moved from near IR to beyond the B band. During the flare a sudden and large increase of the linear polarisation, from about 3% to 10%, was also observed and it remained high at least to the end of May (Massaro et al. 1999). Following the optical flare, we triggered our X-ray observation and ON 231 was observed by *BeppoSAX* in May, with a second pointing performed a month later, in June. We measured the X-ray spectrum from 0.1 up to 100 keV. In both occasions the spectrum had a concave shape, with a break detected at about 4 and 2.5 keV, respectively. In Fig. 2 left panel, we show the SED of ON 231, including our

simultaneous X-ray and optical data of May, 1998. The SED clearly shows that we have detected a concave spectrum in the X-ray band. We interpret the steeper component at energies below the break as due to synchrotron emission and the extremely flat component at energies above the break as due to inverse Compton emission. This is one of the best example in which both the synchrotron and the Inverse Compton component are detected simultaneously and with the same instruments in the X-ray spectrum of a blazar. In this occasion simultaneous optical observations were also performed. Unfortunately the source was already close to the sun and it was impossible to monitor it long enough to search for correlated variability at optical and X-ray frequencies. As shown in Fig. 3, left panel, during the May observation we detected a fast variability event with the flux below 4 keV increasing by about a factor of three in 5 hours. Above 4 keV no variability was detected. The X-ray spectra extracted during the flare has (from the third to the ninth points of the X-ray light curve shown in Fig. 3) the first spectral index steeper than outside the flare ($\Gamma_1 = 2.7 \pm 0.06$ vs 2.4 ± 0.15). The break seems to move at higher energies (best fit values are 4.4 and 3.5 keV, respectively). The second spectral index does not change at all. Thus, the fast variability that we detected shows that the break moves at higher energies when the source flux increases. The lines shown in the SED figure are SSC models that we applied trying to explain the different SED by changing the minimum numbers of parameters. The variability predicted by the model can account for the observed variability in the soft X-ray band and for the much less variable hard X-ray flux, even if the bolometric luminosity does not change between the two *BeppoSAX* observations (note that only the May 1998 observation is reported in Fig. 2 together with a quiescent status from literature data, clearly there is a change in bolometric luminosity between the two SED reported in figure). This can be achieved by changing (even by a small amount) the slope of the injected electron distribution, without changing the total injected power. This will change the synchrotron spectrum above the synchrotron peak, but not the flux below, nor the self Compton flux below the Compton peak, produced by low energy electrons scattering low frequency synchrotron photons (for a comprehensive analysis of this observation see Tagliaferri et al. 2000).

BL Lac: BL Lacertae, being the prototype of the BL Lac class, is one of the best-studied objects. In the X-ray it has been observed by many satellites revealing a complex X-ray spectral variability. In July 1997 following an optical outburst, it was observed with EGRET, *Ross*XTE and ASCA. EGRET found that the flux level above 100 MeV was 3.5 times higher than that observed in 1995 (Bloom et al. 1997). *Ross*XTE found a harder spectrum with a photon index in the range 1.4-1.6 over a time span of 7 days (Madejski et al. 1999). A fit to simultaneous ASCA and *Ross*XTE data shows the existence of a very steep and varying soft component below 1 keV, photon index in the range 3-5, in addition to the hard power law component with a photon index of 1.2-1.4. Two rapid flares with time scales of 2-3 hours were detected by ASCA but only in the soft part of the spectrum (Tanihata et al. 2000). Finally, in November 1997, BL Lac was observed with *BeppoSAX* that detected an energy index of 0.9 ± 0.1 (Padovani et al. 2001). The two *BeppoSAX* ToO observations, performed respectively in June and December 1999, were triggered when the source was in very high optical states ($R \sim 12.5$), but when the source was actually observed by *BeppoSAX* the optical flux was lower ($R = 13.4 - 13.6$). In both observations the source was clearly detected up to 100 keV giving us the possibility to study BL Lac over an unprecedentedly large spectral range (0.3-100 keV) with simultaneous data. BL Lac showed quite different spectra: in June it was concave with a very hard component above 5-6 keV ($\alpha_1 \sim 1.6$; $\alpha_2 \sim 0.15$); in December it was well fitted by a single power law ($\alpha \sim 0.6$). Also in the optical band BL Lac showed two different spectral shapes. Even if optical fluxes are almost similar, the spectrum in June is harder than in December ($\alpha_{opt} = 1.35$ and 2.02 , respectively, assuming an $A_v = 1.09$). The synchrotron spectrum of December seems to be shifted toward lower energies than that of June: its optical spectrum is softer

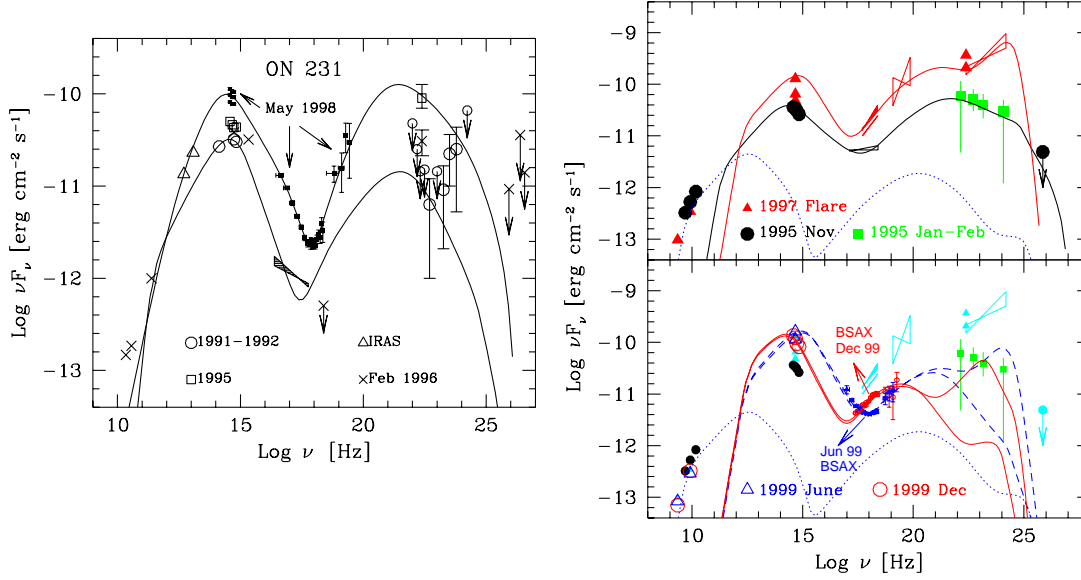


Fig. 2. **Left:** The SED of ON 231 during the *BeppoSAX* May 1998 observation compared to its ‘quiescent’ level, constructed collecting non-simultaneous data found in literature. For more details about the various data points see Tagliaferri et al. (2000).

Right: Four simultaneous SEDs of BL Lac together with our best fit models. Top panel: the 1997 data modeled with a synchrotron inverse Compton model where the emission line photons are important for the formation of the very high energy spectrum. Bottom panel: triangles and circles correspond to the SEDs of June and December 1999, as labeled. For each SEDs, we show the models corresponding to important or negligible emission line radiation for the formation of the γ -ray spectrum.

and *BeppoSAX* detected just the inverse Compton component. The observed Compton spectra are quite different, being much harder in June than in December (see above), and even more so with respect to the previous *BeppoSAX* observation ($\alpha_C = 0.9$, Padovani et al. 2001). In a simple picture one would have expected that the presence of a break in the X-ray spectrum, and hence of a synchrotron component, would have implied a higher source flux. But this is not the case. Although the flux below 1.5 keV was higher during the observation with the spectral break, the 2-10 keV flux was higher in the other two *BeppoSAX* observations. All this can be explained by the fact that both the synchrotron, as shown by the high optical state, and the Compton components are varying. In June, the synchrotron flux prevails in the soft X-ray band and two components are detected in the X-ray spectrum. However, the 2-10 keV band is still dominated by the Compton emission, which is lower but unusually hard. To show the complex behaviour of the spectral emission of BL Lac we plot in Fig. 2, right panel, four different SEDs corresponding to the multi-wavelength campaigns carried out during November 1995, during July 1997, when the source was in a very high state and during our two *BeppoSAX* observations. This figure clearly shows the high degree of variability and complexity of BL Lac’s SED. For the details about the SSC model that we applied and that are shown in the figure see Ravasio et al. (2002).

The X-ray light curve of the June observation looks in general quite constant. However, it reveals an amazing feature about 42 hours after the beginning of the observation. In a very short timescale, about 20 minutes, the [0.3-2 keV] flux doubled: this is one of the

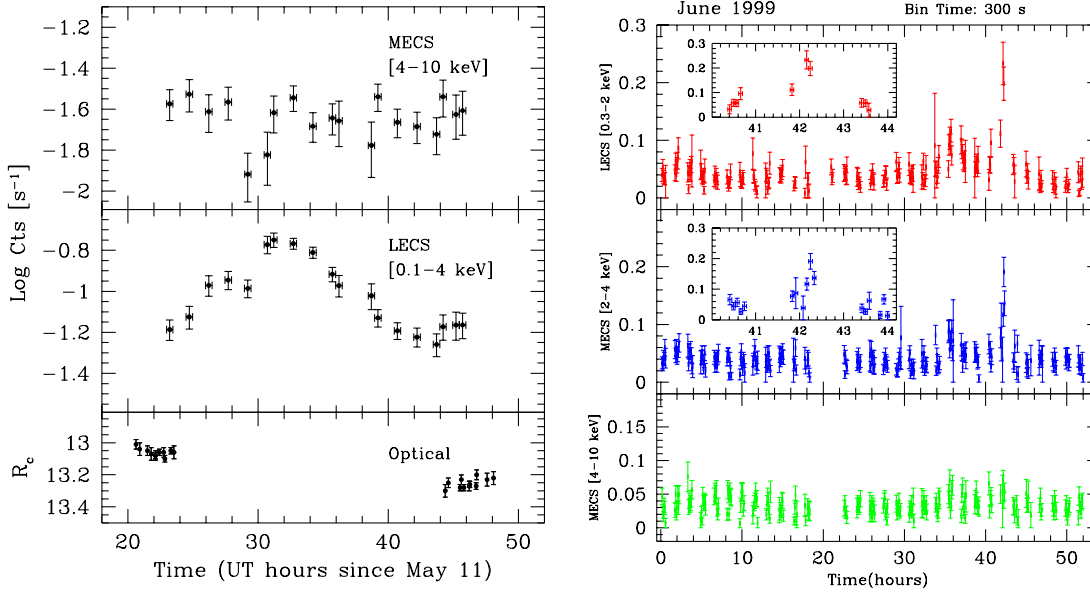


Fig. 3. **Left:** 4-10 and 0.1-4 keV light curves of ON231 during the May 1998 observation. The two figures have the same scale, note the different amount of variability. The optical light curve in the R band is also reported. **Right:** LECS 0.3-2 keV, MECS 2-4 keV and MECS 4-10 keV light curves of BL Lac during the June 1999 *BeppoSAX* observation. Note the clear flare detected at the end of the observations by different detectors (top and mid panels) and better shown in the insert. Note also that above the spectral break, i.e. in the Compton component, the flare is clearly not present (bottom panel).

fastest variability ever measured for any BLLacs. In 2 hours the soft X flux increased 4 times and then decreased to former values. This is not frequency-independent: as can be seen in Fig. 3, right panel, variations are detected only in the softer spectral component. While the synchrotron emission is extremely variable, the inverse Compton component remains almost constant during the observation. This behaviour is very similar to that observed for ON 231. Such an amazing event allows us to put severe constraints on the dimension of the X-ray emission region, on the magnetic field and on the emitting particle energies. The frequency dependence is easily explained when performing the spectral analysis, that highlights a spectral break attributed to the transition from the more variable synchrotron to a very hard inverse Compton spectrum: synchrotron X-ray emitting electrons are more energetic than Compton ones, so they cool faster. During the second 1999 run, *BeppoSAX* detected a softer Compton component along its whole spectral range, which accounts for the constance of the light curves. The comparison of 1995 and 1997 BL Lac Spectral Energy Distributions, extending to γ -ray energies, suggests the presence of different Compton emission mechanisms. We have applied a homogeneous, one-zone synchrotron inverse Compton model (SSC) to the four SEDs shown in Fig. 5. We assumed that a spherical source moves with a bulk Lorentz factor Γ along the jet. We also know that outside the central black hole and accretion disk there should be the broad line region zone. Infact emission lines have been detected in the optical spectra of BL Lac, which have some times exceeded the canonical threshold of 5 \AA of equivalent width to define an objects as a BLLac (Vermeulen et al. 1995). Thus, in our model the seed soft photon distribution is provided by the synchrotron process only if the source is located at a distance, along the jet, greater than a critical distance

z_{BLR} where most of the line emission is produced. Otherwise, we include the radiation energy density of the emission lines, as seen in the frame comoving with the source. The applied model is aimed at reproducing the spectrum originating in a limited part of the jet, thought to be responsible of most of the emission. This region is necessarily compact, since it must account for the fast variability. In our model we assumed that the dissipation region of the jet corresponds to the collision of two blobs or shells moving at slightly different velocities. This is the “internal shock” scenario for blazars, as proposed by Ghisellini (1999) and Spada et al. (2001) (see also Madejski et al. 1999). We therefore have that different SEDs correspond to different collisions, that can occur at different location in the jet. Some of them may be located within the size of the BLR, while others occur outside. This has a quite dramatic effect on the spectrum, since within the BLR the energy density of the emission line radiation easily exceeds the magnetic and the synchrotron energy densities. Therefore, collisions occurring at $z < z_{BLR}$ emit most of their power in the GeV band, as happened in the 1997 flare. On the contrary, for collisions beyond z_{BLR} the emission line radiation is negligible, and the Compton to synchrotron luminosity ratio is controlled by the ratio between the magnetic field and the synchrotron energy densities. This is the most plausible scenario for the 1995 SED, characterised by the fainter and steeper EGRET spectrum. For the 1999 June SED, the very short variability timescale suggests a very compact region, and hence a location for the inverse Compton region within the Broad Line Region, closer to the jet apex. For the 1999 December observation we do not have tight constraints from variability to discriminate if regions are within or outside the BLR. For more details about the model see Ravasio et al. (2002).

PKS 2005-489: this bright BL Lac object was observed following an active X-ray state detected by *Ross*XTE. This is the only X-ray trigger of our ToO campaign. The source was in a very high state with a continuum, detected up to 200 keV, well fitted by a steepening spectrum due to synchrotron emission only. We did not detect fast variability during the observation. Our X-ray spectrum is the flattest ever observed for this source, with a synchrotron peak frequency located between 10^{15} and 2.5×10^{16} Hz, depending on the model assumptions. Although the source has been observed over a large range of X-ray fluxes, the different X-ray spectra, as measured by various satellites, are consistent for this object with relatively little changes of the peak frequency of the synchrotron emission, always located below 10^{17} Hz (for more details see Tagliaferri et al. 2001).

S5 0716+714 & OQ 530: these two sources were both observed in the year 2000 due to optical triggers. For both of them we detected a break in the spectrum that again can be interpreted as due to synchrotron and inverse Compton emission. In the case of S5 0716+714 we detected again fast variability only in the synchrotron part of the spectrum. This different variability behaviour of the two components was already detected in a previous *BeppoSAX* observation of this source (Giommi et al. 1999). For both sources our observations have the highest flux, when compared with previous X-ray observations, but we have no indication of a strong variability in the SED of both sources. We have also simultaneous TeV observation performed with the HEGRA telescope, but both sources are not detected (Tagliaferri et al. 2002).

OJ 287 & MS 14588+2249: these sources were observed in 2001 as part of two different ToO programs. Also in these two cases the triggers were from optical observations. However, both sources were detected in a low status in the X-ray and their spectra are well represented by a single power law model. For OJ 287 the spectrum is flat $\alpha_x = 0.45 \pm 0.08$ and due to Compton emission, while for MS 14588+2249 it is steeper, $\alpha_x = 1.71 \pm 0.15$ and due to synchrotron emission (for more details see Massaro et al. 2002).

Mkn 421: this is one of the most studied BL Lac object in the X-ray band. Spectacular variability has been detected during long *BeppoSAX* observations, in one case, in April 1998, simultaneously with a TeV flare, detected also in the X-ray band. These

data show that the X-ray and TeV intensities are well correlated on timescales of hours, implying that the X-ray and TeV photons derive from the same region and from the same population of relativistic electrons (Maraschi et al. 1999). The good statistic and large *BeppoSAX* energy band allowed Fossati et al. (2000) to detect the peak of the synchrotron component shifting to higher energies during the rising phase and then decreasing to lower energies during the decay phase. In June of the same year a ToO observation was triggered when Mkn 421 was detected to be in a high state by one of the *BeppoSAX* Wide Field Camera (Malizia et al. 2000). Also during this ToO observation the source showed short-term temporal and spectral variability. The source hardens while brightening and the synchrotron peak moves to higher energies, in agreement with previous results and in particular with the findings of Fossati et al. (2000). In Fig. 4 we report the 0.1-100 keV νf_ν spectra of Mkn 421 recorded during the ToO and two previous *BeppoSAX* observations when the source was weaker (from Malizia et al. 2000). This clearly shows that the synchrotron peak moved to higher frequencies when the flux increased.

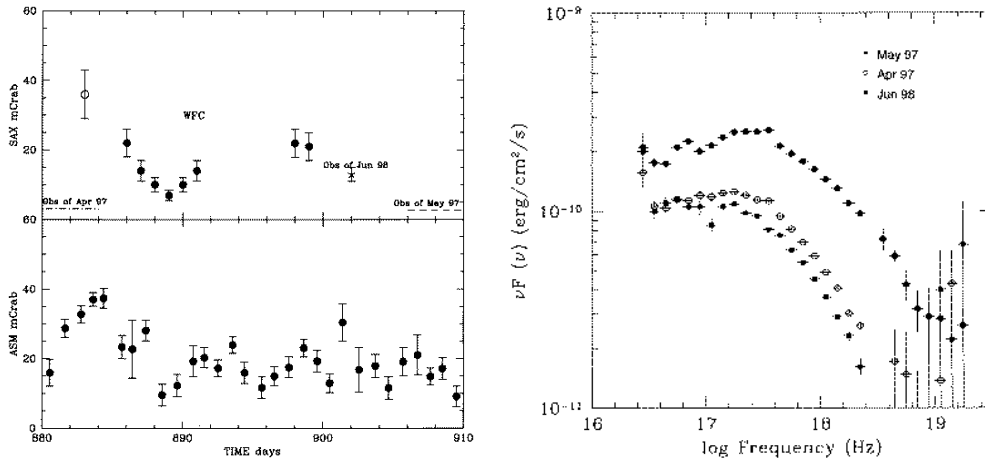


Fig. 4. **Left:** *BeppoSAX* WFC light curve (top panel) compared with RXTE ASM one-day average (bottom panel) during the *BeppoSAX* observation of 1998 June. In the top panel, the dashed lines identify the flux levels recorded during the two *BeppoSAX* exposure in 1997. The star indicates the flux seen during the June 1998 observation. **Right:** 0.01-100 keV spectra of Mkn 421 during three *BeppoSAX* observations. Note how the peak of the emission moves to higher energies when the flux increases. Both figures are from Malizia et al. (2000).

3. Conclusion

We presented some of the most important results that were obtained with *BeppoSAX* ToO observations of Blazars. They immediately show the importance of observing in the X-ray band Blazars that are known to be in a high state. With *BeppoSAX* this is even more true: thanks to its large energy range, it has been possible to simultaneously detect both the synchrotron and the Compton components. We detected fast variability events that allowed us to put constraints on the size of the emitting region and to infer the properties of the jets responsible for the Blazars' emission.

But we had also limits in this projects. For instance, it can be seen from Table 1 that the Blazars ToO program has been dominated by optical triggers. Thus, we are probably biased towards sources that have an higher optical variability. These should be the blazars that have the synchrotron peak in the IR-optical band, i.e. sources with

the peak on the left side of the bands in which the blazars are usually monitored. These are of course essentially LBL or intermediate blazars. Sources that have the synchrotron peak in the UV–X-ray band are not expected to show strong optical variability. They are probably more easily detected in a high state from systematic monitoring at higher frequencies. Of course this is much more difficult than in the optical and this explain while in Table 1 there are only two X-ray triggers. This could explain the fact that most of the sources observed as ToO observations were in a high state in the X-ray band, but not in an extremely high state. Moreover, we note that from the optical trigger to the actual X-ray observations normally there are delays of a few days and this could also explain while we did not find sources in exceptionally high states.

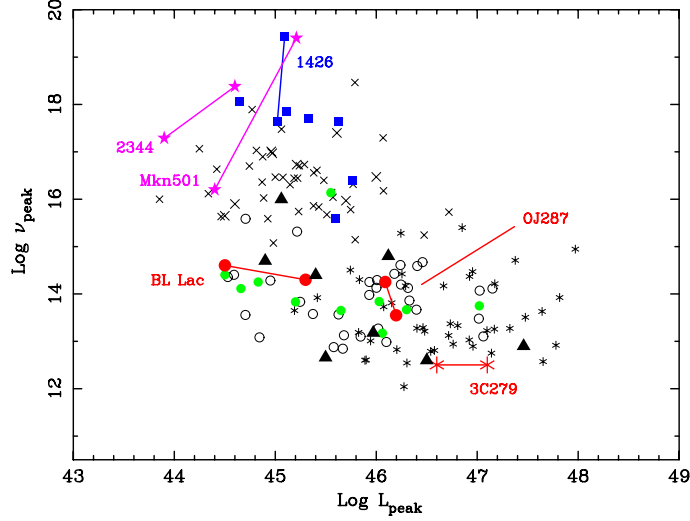


Fig. 5. Peak frequency vs. luminosity at the peak frequency for a sample of Blazars. Note how the high peak objects seem to show higher variability of the synchrotron peak frequency, while lower peaked sources show a rather steady ν_{peak} among different luminosity states (from Costamante et al. 2000).

These observations shows also that the synchrotron peak frequency does not seem to vary a lot in the LBL or intermediate objects. On the contrary, strong shifts have been observed for Mkn 501 and Mkn 421 that are HBL. This is in line with the findings of Costamante et al (2001), that studied with *BeppoSAX* blazars with extreme synchrotron peak frequencies ($\nu_{peak} > 1$ keV). They found that these sources seems to be characterised by larger ν_{peak} variability, compared with lower ν_{peak} objects (see Fig. 5).

We detected strong spectral variability, founding in the same source either two or only one component. We also found fast variability, but only in the synchrotron component of sources showing both the synchrotron and the Compton components. Fast variability is present also in the optical band, but it is less pronounced and there is no one to one correspondance. All this can be inteprted with the presence of a steady Compton component, and the erratic variability of the synchrotron tail emission, coming in and out of the soft X-ray band. The Compton emission we see in the X-ray band is well below the Compton peak and it is produced by low energy electrons scattering low frequency synchrotron photons. The variability seen in the synchrotron part can be obtained by changing the slope of the injected electron distribution, without affecting the total injected power. Time to time there are variability also in the Compton component and this imply a strong modification of the overall blazar SED, as in the case of the 1997 BL Lac flare. All these behaviours can be reproduced by the presence of relativistic

jets dominated by shock events produced by colliding shells (e.g. Spada et al. 2001).

In any case these observations show the importance of observing Blazars over such a large X-ray energy band while they are in a high state. It will be crucial to perform these ToO observations also in the future and in particular for Blazars that are detected in a high state in the X-ray or TeV bands, now that new and more sensitive TeV telescope will be operational. In the foreseeable future these ToO observations, as the one carried out with *BeppoSAX*, will be possible probably either with the combination of simultaneous observations from Integral and other soft X-ray satellites (such as XMM-Newton or Chandra), or with the Swift satellite. Swift will be launched at the end of 2003. Swift is dedicated to the study of Gamma Ray Bursts, but it should also observe other interesting sources, whose emission goes from the soft to the hard X rays, and Blazars are obvious good candidates.

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